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NATIONAL SCIENCE POLICY

by

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NATIONAL SCIENCE POLICY

CALLS for a government science program, to provide for more coordination and centralization and less duplication among administrative units, were voiced in this country long before launching of the first sputnik by the Soviet Union in 1957 made the United States acutely conscious of its shortcomings in scientific endeavor. Vannevar Bush, head of the wartime Office of Scientific Research and Development, wrote 15 years ago:

> We have no national policy for science. The government has only begun to utilize science in the nation's welfare. There is no body within the government charged with formulating or executing national science policy. There are no standing committees of the Congress devoted to this important subject. Science has been in the wings. It should be brought to the center of the stage—for in it lies much of our hope for the future.[1]

Now, a decade and a half later, the situation described by Bush remains almost unchanged. Although legislators and administrators have repeatedly examined and criticized the role of the government in the nation's scientific effort, they have come to agreement only lately on the need to expand basic research, to do more to promote science education, and to formulate a comprehensive federal science policy. Little progress along these lines can be expected as the Eisenhower administration draws to a close and the present session of Congress enters the home stretch. But reorganization of the government's scientific programs will be one of the principal tasks confronting the President and the Congress elected next November.

Americans have won more than one-half of the Nobel prizes awarded in the sciences since 1945, and American science currently has a scope and depth unequaled elsewhere. But there is fear that the highly integrated structure of scientific development in the Soviet Union may prove in the long run to be more productive of accomplish-

[1] Vannevar Bush, *Science the Endless Frontier* (Report to the President, July, 1945). See "Government and Science," *E.R.R.*, 1945 Vol. II, p. 274.

ment. Sen. Hubert H. Humphrey (D Minn.), chairman of the Subcommittee on Reorganization and International Organizations of the Senate Committee on Government Operations, wrote early this year that "During the last decade the United States and the entire world have been caught up and swept along by the fantastic advancements in the scientific world." Humphrey added that the Executive Branch and the Congress had been able "through more or less haphazard and unrelated actions . . . to meet the challenge of greater technological advancements," but he thought it imperative that the United States be prepared "to carry on a comprehensive and constructive program to meet the challenge of world communism." The senator called for "a complete re-evaluation . . . of present federal operations in science, research, and technological fields," and for prompt and effective action "to coordinate and improve the existing organizational structure of our government which carries on these functions." [2]

Lack of Coordination in Scientific Activities

Periodic attempts have been made to centralize and coordinate scientific activities of the federal government. As Sen. Estes Kefauver (D Tenn.) said at hearings of the Senate reorganization subcommittee, May 28, 1959: "The problem is how to bring order out of chaos in our research and development programs. As is all too often the case in the intricate structure of government where free peoples govern themselves, agencies, boards, bureaus and departments become so involved in jurisdiction and prerogatives that [the programs] are hopelessly scrambled."

As scientific and technological projects have expanded, and as they have become increasingly more important to national security, observers have begun to ask whether the government's numerous scientific activities make up a balanced whole, and whether individual programs, which often do not fit into a departmental set-up, can be more effectively integrated and directed. Dael Wolfle, executive director of the American Association for the Advancement of Science, wrote recently:

> The percentage of the nation's total scientific effort that is financed by the federal government has become so great that the government cannot escape major policy responsibility. It establishes policy anyway, whether it wills to do so or not. Under these

[2] Hubert H. Humphrey, "The Need for a Department of Science," *Annals of the American Academy of Political and Social Science*, January 1960, p. 28.

circumstances, conscious, deliberate arrangements for policy responsibility and authority are essential.[3]

However, no clear pattern of organization has emerged. Scientific activity in universities, private foundations, government and industry continues to be administered by a complex of agencies inter-related only through a network of grants and contracts. The structure built up by the Executive Branch to meet national security requirements has been criticized as weak in terms of sound policy development, provisions for keeping Congress informed, ability to meet new demands, and general operational effectiveness.[4]

Nearly half a hundred government bureaus, divisions, independent agencies, and advisory committees are engaged in some form of scientific activity. The President's Science Advisory Committee noted a year ago that each of these agencies and bureaus "continues to formulate its own policies in science and technology with insufficient reference to the policies of others." The lack of careful planning and coordination in expenditure of the billions laid out annually for research and development is a source of deep concern to scientists.

Conflict Over Priorities in Science Planning

Wallace R. Brode, science adviser to the Secretary of State, recently pointed to the danger of leaving decisions of policy and priority to individual agencies. He assailed the position taken by Atomic Energy Commission Chairman John A. McCone, who had voiced the conviction that "the United States—if it is not to become technologically and economically inferior to the U.S.S.R.—must work out methods of marshaling its scientific and technical talents for concentrated top priority work on projects of overriding significance." Brode cautioned that "overlapping expansion and growth of our science programs" meant that "none of these major programs can be adequately supported except at the expense of the less glamorous areas of science, education, and culture, which are, nevertheless, essential to

[3] Dael Wolfle, "Government Organization of Science," *Science*, May 13, 1960, p. 1414.

[4] John C. Honey, executive associate of the Carnegie Corporation, has said: "Prior to 1957 . . . the organization for the conduct of scientific affairs was clearly chaotic. . . . Interest in scientific affairs in the White House was tepid; the advisers on science policies were timid or distracted by other responsibilities. . . . The derogation of basic research by a Secretary of Defense in this period and the vacillation over defense research budgets were symptomatic of Executive Branch attitudes."—John C. Honey, "The Challenge of Government Science," *Annals*, January 1960, p. 2.

our basic welfare." He asserted that "a national science policy is needed for a wise and rational distribution of scientific activities, so that space, defense, education, atomic energy, oceanography and medical research are not bidding against each other for limited available support." [5]

Critics say the nation is already devoting too large a proportion of its scientific resources to purposes of national security, with the result that hardware requirements are over-influencing the course of scientific innovation. They think the government ought to expand its sponsorship of basic scientific research, even, if necessary, at the expense of curtailing present emphasis on spectacular developmental work and on space exploits. Brode stated that in formulating a science policy Congress and the Executive Branch should consider, among other problems, "the direction in which science will advance and . . . the areas in which continuing or new programs are to be supported"; relative priorities to be placed on scientific programs; "administration, financing, evaluation, and support of our science programs within the government"; and "distribution of responsibility for the carrying out of scientific programs between government laboratories and university, private, industrial, and foreign facilities." [6]

James B. Fisk, president of the Bell Telephone Laboratories, told the Senate Government Operations subcommittee on national policy machinery, April 26, that "We must avoid the danger of too much planning of our national science, but we must find more effective mechanisms for overall comparative judgments of national priorities." Ruben F. Mettler, vice president of Space Technology Laboratories, said at the same hearing that "Policy planning has frequently suffered because at any given point in time too much progress was expected in the short run, say three to five years, and too little progress was anticipated in the longer run—say 15 to 25 years."

Role of the White House Scientific Advisers

To achieve more effective development of policies in the Executive Branch on the overall relationship of government to science, President Eisenhower in 1957 shifted his Science Advisory Committee from the Office of Defense Mobilization to the White House, and the following year

[5] Wallace R. Brode, "Development of a Science Policy," *Science*, Jan. 1, 1960, p. 10.
[6] *Ibid.*, p. 12.

he appointed a Special Assistant for Science and Technology. Then, in March 1959, the Federal Council for Science and Technology was created by executive order. These three currently afford the only central meeting places in the government for all branches of scientific activity.

The President's Science Advisory Committee is principally concerned with making scientific analysis and counsel available where needed in formulating national policy. James R. Killian, chairman of the Massachusetts Institute of Technology and formerly the President's Special Assistant for Science and Technology, pointed out before the American Association for the Advancement of Science on Dec. 29, 1958, that the 18 members of the Science Advisory Committee—all non-governmental scientists—had "no operational responsibility." Their function was "to provide a communications center for science in the federal government and thus to facilitate intercommunication among various scientific activities within the government and between the civilian scientific community and the government." Killian went on to say: "In carrying on its work for the President, the committee is organized into a group of panels which include both regular committee members and other engineers and scientists selected from outside the ranks of the committee. . . . The intensive studies made possible by the individual panels have enabled it to tackle problems which would not be effectively undertaken by the committee itself with its limited membership." [7]

The Science Advisory Committee serves as a board of consultants to the Special Assistant for Science and Technology, George B. Kistiakowsky, who is also the chairman of the committee. The Special Assistant sometimes sits in on meetings of the National Security Council and the Cabinet. Special recognition thus is given to the fact that science and technology have a direct impact on national security and on formulation of public policy.

Federal Council for Science and Technology

To promote closer cooperation among federal agencies in planning and managing the national scientific effort, the Advisory Committee's panel on research policy in December 1958 recommended establishment of a Federal Council

[7] The panels include space science, scientific information, research policy, science and technology in foreign affairs, and science and engineering education.

for Science and Technology, consisting of policy-making officials of federal departments and agencies concerned with science. When President Eisenhower signed an executive order, March 13, 1959, creating the new nine-man council, he expressed the belief that it could "effectively aid the objective of improving the ways in which the federal government uses and supports science."

In addition to its chairman, who is the President's Special Assistant for Science and Technology, the council includes representatives of the Departments of Agriculture, Commerce, Defense, Health, Education and Welfare, and Interior, the Director of the National Science Foundation, the Administrator of the National Aeronautics and Space Administration, and a member of the Atomic Energy Commission. The functions of the council are:

> To consider problems and developments in the fields of science and technology and related activities affecting more than one federal agency or concerning the overall advancement of the nation's science and technology; to recommend policies and other measures to provide for more effective planning and administration of federal scientific and technological programs; to identify research needs, including areas of research requiring additional emphasis; to achieve more effective utilization of scientific and technological resources of the federal agencies, including elimination of unnecessary duplication; and to further international cooperation in science and technology.[8]

The Federal Council for Science and Technology is in position to coordinate the activities of agencies which have related research and development programs. However, at a hearing on May 28, 1958, Sen. Humphrey, chairman of the reorganization subcommittee, opposed what he felt was "the desire of the present administration to center within the Executive Office of the President all control over civilian science operations." Such centralization of control, Humphrey asserted, "tends to pre-empt the scientists who are thoroughly informed . . . about governmental science operations for the benefit of the President alone, and effectively prevents the Congress from obtaining information from qualified experts in the fields of science."

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[8] Alan T. Waterman, Director of the National Science Foundation, before reorganization subcommittee, May 28, 1959.

Postwar Expansion of American Science

GROWTH in the number and size of government scientific and technical groups, and in the scope and significance of their work, over the past two decades has been spectacular. Both old and new agencies have expanded rapidly. Scientific projects carried out by universities under government contract have increased enormously.[9] A number of government-financed laboratories like the Jet Propulsion Laboratory, the Brookhaven National Laboratory, and the National Radio Astronomy Laboratory have been established. And competition with the U.S.S.R. has spurred creation of new governmental or quasi-governmental agencies such as the National Aeronautics and Space Administration and the National Science Foundation to aid in scientific research and development. Expenditures on research and development have doubled in the past five years. The total for the fiscal year 1961 was estimated in the federal budget for that period at no less than $8.4 billion.[10]

Development of the Atomic Energy Commission

The two major issues raised at congressional hearings in 1946 on methods of controlling atomic energy—the great new source of political and economic power developed during the war—concerned the question of civilian as opposed to military control and questions relating to the administration and powers of the proposed regulatory agency.[11] Scientists who had participated in the Manhattan District project, which developed the atomic bomb, formed numerous groups to lobby against any form of military control. The military said that, while national security had to come first, they sought control over no more than the military applications of atomic energy.

The Atomic Energy Act of (Aug. 1) 1946 provided for

[9] The federal government in 1940 granted $15 million to colleges and universities for research and development projects, mostly in agriculture. Federal agencies today are disbursing about $500 million a year for a wide variety of contract projects.—John C. Weaver, "What Federal Funds Mean to the Universities Today," *Annals*, January 1960, p. 116.

[10] $5.8 billion for the Defense Department, $1.1 billion for A.E.C., $900 million for NASA, $375 million for the Health, Education and Welfare Department, $138 million for the Agriculture Department, $100 million for the National Science Foundation. A task force of the committee headed by Charles H. Percy—named by the Republican National Committee last year to draw up a program of national goals—asserted that by 1976 the United States "should be spending as much as $36 billion each year" on research and development.—Republican National Committee, *The Impact of Science and Technology* (Oct. 4, 1959), p. 9.

[11] See "Control of Atomic Energy," *E.R.R.*, 1946 Vol. I, p. 286.

regulation through a commission of five members, rather than a single administrative head, because Congress felt that no one individual, other than the President himself, should have the authority of final decision in matters affecting a force vital in war and of vast potential importance in peace. It preferred to leave the complex questions certain to arise in development of nuclear energy to the collective judgment of a group of able men. Only the momentous decision on use of nuclear weapons in combat was reserved for the high authority of the President alone.

The A.E.C. originally administered its programs through five divisions: production, research and development, engineering, military application, and biology and medicine. The engineering division in 1949 became part of a new division of reactor development. The commission has maintained close relationships with industry and with academic institutions.[12]

National Science Foundation and Basic Research

It became apparent at the end of World War II that the United States needed to strengthen its efforts in basic scientific research. Technological advances had been extraordinary during the war period, but it was realized that the wartime advances had been due principally to changes in methods of production, not to findings of basic research; that the outstanding achievements of the war effort had been made possible in a great number of cases by basic research done abroad prior to 1940.[13] Vannevar Bush accordingly recommended, in a report to the President in 1945, that a National Science Foundation be established to support education and basic research in the sciences.

After five years of bitter debate, the proposed foundation was created in 1950 as an independent federal agency.[14] The preceding legislative battles resulted in a series of compromises that gave N.S.F. a 24-member board of directors and caused its interests to overlap those of

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[12] More than 20 laboratories of universities and industrial companies are under contract with A.E.C. These laboratories have an annual budget of about $600 million and employ approximately 42,000 persons.

[13] Alan T. Waterman, *Program Activities of the National Science Foundation* (1959), p. 2.

[14] Bush had estimated in 1945 that the foundation, if established then, would spend about $125 million on basic research and education by 1950. However, funds available to N.S.F. in the first few years of its existence never reached even the $15 million annual authorization. Until 1959, when sputnik finally boosted the total to $130 million, the agency's largest annual appropriation had been $40 million, half of which was disbursed in support of basic research.

the A.E.C., of the Department of Health, Education and Welfare, and of other federal agencies with responsibilities in science and technology. President Truman in 1947 had vetoed a previous bill to establish a National Science Foundation on the ground that its provisions represented "a marked departure from sound principles for the administration of public affairs." Truman objected particularly to placing "full governmental authority and responsibility . . . in 24 part-time officers whom the President could not effectively hold responsible for proper administration."

The 1950 act, though signed by Truman, failed to meet the objections he had cited three years earlier. The Senate Committee on Government Operations observed almost a decade later: "The structure of the National Science Foundation does not insure responsible administration of the law. So long as there is such a wide diffusion of supervision and administrative control over the activities of the National Science Foundation, and it has no operating functions, it will be impossible for that agency, as presently constituted, to properly advance the necessary programs for the development of the basic sciences." [15]

Despite such criticism, N.S.F. has been made increasingly responsible for federal support of general-purpose basic research and of education in the sciences. To promote expansion of the supply of scientific manpower, for example, the foundation in 1959 budgeted $33 million for summer teaching institutes, $13 million for graduate fellowships, and $16 million for special projects in science education.

Reorganization of Space Program Under Nasa

The National Aeronautics and Space Administration, the federal government's newest scientific agency, was organized on Oct. 1, 1958. Historically, the civilian space agency is a successor to the National Advisory Committee for Aeronautics, which was established in 1915. The President's budget for fiscal 1961 pointed out that Nasa was "responsible for conducting research on the problems of aeronautical and space vehicles and their components, and operation of vehicles for the exploration of space, and other non-military applications."

The question of whether responsibility for American

[15] *Science and Technology Act of 1958, Analysis and Summary* (April 23, 1958), p. 24.

space projects should be placed under military or civilian control, or be divided between them, was debated by Congress in 1958 as the question of control of atomic energy had been debated in 1946. The decision two years ago was to place under control of the civilian agency, not all space projects, but all not determined by the President to be primarily associated with national defense.[16] The 1958 act provided for creation, not only of NASA, but also of a policy-making council to advise the President on space policy and of a civilian-military liaison committee to resolve differences between NASA and defense agencies engaged in space projects.

At present, the Defense Department's Advanced Research Projects Agency, the Air Force, the Navy, and the Army are all involved in military aspects of space activity. Projects conducted by NASA, moreover, are dependent on the cooperation of more than a dozen other federal agencies ranging from the Department of Commerce (National Bureau of Standards and Weather Bureau) to the Smithsonian Institution. The resultant confusion and inevitable friction have aroused criticism in Congress. Senate Majority Floor Leader Lyndon B. Johnson (D Texas) said on March 3, 1959, that "If we act now, we can head off conflicts in responsibility which, if allowed to develop unchecked, could become vested interests impossible to change." William H. Pickering, head of the Jet Propulsion Laboratory at the California Institute of Technology, called at a hearing before the House Science and Astronautics Committee last Feb. 24 for unification of civilian and military space programs under NASA. But some assert that a unified effort should be placed under military control because defense needs are paramount.

Complexity of the Military Scientific Programs

Military scientific programs were scheduled to receive 85 per cent of the federal funds for research and development in fiscal 1960.[17] Both the programs and the administrative organization are immensely complex. Sen. Kefauver observed on May 28, 1959, that "In the Pentagon alone, the maze of committees and departments is enough to confound

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[16] See "National Space Policy," *E.R.R.*, 1959 Vol. II, pp. 918-920.

[17] A multitude of laboratories, development centers, and test installations carry on military research and development activities ranging from high altitude balloon ascensions to polar expeditions. Some projects are operated directly by the government with civil service and military personnel, others by operating contractors, and a few by a combination of both methods.

progress itself." Willis H. Shapley, chief of the Air Force section of the military division of the Bureau of the Budget, said recently that "The basic organizational problem is to . . . centralize responsibility for the crucial decisions involving selections among alternative military capabilities and technical approaches, while at the same time decentralizing detailed management to allow a maximum of freedom and flexibility in the actual conduct of research and development work."

> Too much central direction will lead to an impossible bureaucracy that would stifle progress. Too little central direction will permit competing alternative programs to run wild on a unilateral basis. . . . In theory, the answer is obviously to centralize only the decisions that have to be made at the top and decentralize everything else. The practical difficulty is that merely to identify on a current basis the problems that need to be resolved at the top requires a complete and continuing review of the entire program on a fairly detailed basis.[18]

Broad issues relating to military research and development are handled by the National Security Council and reflect that body's assessment of national security demands. John C. Honey of the Carnegie Corporation has contended, however, that the council "can never serve as a detached, reflective agent to examine the future needs and responsibilities of the government since it must try to resolve conflicting departmental views and come up with compromise solutions for the President." [19]

Military research, development, test and evaluation programs are currently conducted by the separate services and the Advanced Research Projects Agency under the direction of Herbert F. York, Director of Defense Research and Engineering in the office of the Secretary of Defense. This is the chain of command as revised by the Reorganization Act of 1958. It represents the latest of a series of attempts to improve central leadership and achieve a balance that will simultaneously give more effective control over major decisions and more decentralized responsibility for detailed management of research and development work. Organization of science and technology in the Defense Department is in a state of flux, however, and it will probably remain so until a coordinated national policy has been formulated.

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[18] Willis H. Shapley, "Special Problems of Military Research and Development," *Annals*, January 1960, p. 73.

[19] John C. Honey, *op. cit.*, p. 7.

Proposals for a Department of Science

SCIENTISTS, administrators, and legislators are generally agreed that something should be done to coordinate the government's scientific efforts. Many fear, in view of the rapid advance of science in the U.S.S.R., that there is too much division in the United States between civilian and military, government and industry, applied science and basic science, with the result that various critical programs cannot be conducted as efficiently as they should be. The President's Science Advisory Committee reported more than a year ago, in a study called *Strengthening American Science*, that "What is lacking is an effective instrument of government . . . that can promote closer cooperation among federal agencies in planning and managing their programs in science and technology and achieving their coordination."

Sen. Humphrey agreed that clear-cut responsibility was necessary. "Fettered leadership . . . is all that can be expected from makeshift, compromise arrangements devoid of statutory authority and totally dependent upon voluntary cooperation for . . . achievements." Attacking government officials who thought that the President's new Council for Science and Technology would fill the gap, Humphrey said early this year:

> Those who place their reliance on coordinating devices such as inter-agency committees for improving communications and for providing stimulus to government science activities fail to recognize the built-in limitations of these approaches . . . Inter-agency committees . . . are inevitably restricted by the views of the most pedestrian and unimaginative members.

What was needed, Humphrey said, was "dynamic, forceful and continuing leadership which could best come from a Cabinet department with clear-cut responsibility and authority in the field of science and technology." [20]

Problems in Coordinating Scientific Activities

There is considerable popular support for proposals to bring all the government's numerous scientific and technological operations together in a single department under a secretary of Cabinet rank. This would create a science branch on a par with other departments. There would be

[20] Humphrey, *op. cit.*, p. 33.

one Cabinet officer to whom Congress could turn for information and whom Congress could hold responsible for all scientific activity. But although the idea sounds logical, it is believed to be impractical.

No plan for such an all-encompassing science department has been seriously advanced by scientists themselves, for the primary role of science in the federal government is as an aid or tool in carrying out other responsibilities. Laboratories and scientific departments are established and supported primarily for the services they can render. Consequently, it is thought that the organization of scientific activities should be planned to facilitate the scientific support of major departments. Scientific activities which are intimately related to the operating responsibilities of an agency, for example the Department of Agriculture, should therefore remain under the direction of that agency.

Hunter Dupree,[21] testifying before the Senate subcommittee on reorganization, April 17, 1959, said: "Science must be compared not with agriculture or commerce but with economics or security. It is a pervasive thing, which had, even by the 1880s, penetrated so many different areas of government activity that a joint congressional committee found it impossible to define a separate area for a Department of Science."

Suggestions for Departmental Centralization

Congress has led in the demands for a Department of Science and Technology, perhaps because it has nowhere to turn for an authoritative, overall review of the nation's scientific programs. Sen. Humphrey said on May 28, 1959, that the present situation "makes it impossible for a committee of Congress to ever get full information upon which to take constructive action." Humphrey's bill for a Department of Science and Technology would include only the N.S.F., NASA, A.E.C., the Bureau of Standards, and four branches of the Smithsonian Institution.[22] Although the proposed merger would effect only a small reduction in the total number of scientific agencies, it would unite those which have great popular interest, occupy most congressional attention, and account for a substantial portion of the scientific budget.

[21] Associate professor of history at University of California.

[22] The Smithsonian Institution branches would be the Division of Astrophysical Research, Division of Radiation and Organisms, Canal Zone Biological Area, and International Exchange Service.

Lloyd V. Berkner, president of Associated Universities, has used different criteria in choosing the agencies he thinks should be merged. Berkner's goal for such a merger would be to increase the effectiveness of the agencies themselves. His plan, outlined in a speech last Feb. 18, would exclude all independent agencies, such as A.E.C. and NASA, all agencies supporting research carried on by others, such as N.S.F., and all research and development activities that constitute integral parts of the agencies in which they are now located, such as the research facilities of the Department of Agriculture and the Department of Commerce. When these groups are excluded, there remain a number of scientific and technical bureaus which could be moved, without serious loss to the departments in which they are now located, because they are not integrated into those departments and are not supported as effectively as they might be.

Wallace R. Brode, science adviser to the Secretary of State, proposed another plan in a speech last Dec. 28 in Chicago: "A Department of Science, while not removing from agencies such as Defense and Agriculture, concerned with applications, the research programs specific to their missions, should include all major segments of science not specifically pertinent to those missions." Such a department would have immense scope, with "separate bureaus or institutes . . . to deal with space, atomic energy, medicine, weather, patents, science information, physical science, geology and other recognized areas of importance." It has been observed that Brode's plan would have the advantages given by centralization of authority and responsibility. The Department of Science would be of such size and importance within the government that it would have major responsibility for new developments "and could take a more important role in making scientific policy than do any of the existing scientific agencies." [23]

Opposition to Creation of Science Department

Proponents of a Department of Science and Technology believe that the merger of various agencies would reduce duplication of effort and result in superior scientific achievement. However, each proposal has weaknesses which seem to raise as many difficulties as would be removed. William F. Finan, a Budget Bureau official, said on May 28, 1959,

[23] Dael Wolfle, *op. cit.*, p. 1412.

at the hearings of the subcommittee on reorganization, that he doubted whether "there exists any workable organizational concept upon which a Department of Science and Technology could advantageously be based." [24]

Alan T. Waterman of the National Science Foundation agreed. He said that a Department of Science and Technology, as proposed by Sen. Humphrey's bill, would "obviously not resolve the major problems of budgeting and coordination since they would bring into the proposed department agencies spending only about 20 percent of the total funds expended by the government for scientific research and development." Waterman added that "Coordination of most of the scientific activities of the government would, therefore, still have to be accomplished outside the [proposed] department."

Critics of the Humphrey bill do not see any common purpose underlying activities of N.S.F., A.E.C., NASA, the Bureau of Standards, and the Smithsonian Institution. N.S.F. and the Smithsonian are devoted to basic research and education in the sciences. These activities would constitute only a minor fraction of the total budget of a Department of Science and would be likely to suffer in consequence. A.E.C., biggest of the agencies in the proposed department, has much the largest budget and most of its funds are used for production rather than for research and development. Critics deem it unwise to subordinate a number of agencies devoted to research and development to a much larger one in which major emphasis is placed on production. Waterman, as Director of N.S.F., said that "One agency should stand solely for basic research . . . so that it will not be swallowed up or pushed into a minor place in a large department."

Other points advanced during congressional hearings against establishment of a Department of Science included:

1) The super-position of a centralized department which would attempt to supervise or control research and development activities of other agencies would have demoralizing effects.

2) If such a department did not have full control, the result would be divided responsibility.

3) Because the pending legislation contains no provision for

[24] Elmer Hutchisson, director of the American Institute of Physics, said at the same hearings that "'Science' is basically well-organized common sense and should pervade all branches of government and not be set apart in a separate department. . . . I would hope, as time goes on, that all departments would become more scientific."

continuing development of an overall science policy, the White House still would have to grapple with that problem.

Persons in the administration opposing the creation of a Department of Science think there is great danger in attempting to over-organize and centralize creative activity. They believe that scientific effort should be widely decentralized, and competitive, and that coordination should come through informal mechanisms, not administrative fiat.

Bill to Establish Bipartisan Study Commission

Witnesses appearing at the subcommittee hearings in April 1959 suggested that a bi-partisan commission be established to consider whether or not a Department of Science and Technology should be created and, if created, what activities should be incorporated in such a department. A bill to this effect was introduced on May 5, 1959, by Sen. Humphrey. He said: "If such a department were found to be desirable, the commission should then recommend to the President and the Congress which functions now being performed by other departments and agencies of the government should be transferred to such a department."

It was the view of the subcommittee that the commission should be composed of eminent authorities in the field of science, members of Congress, and representatives of federal agencies engaged in science, such as the heads of the three major independent science agencies. Administration witnesses before the subcommittee a year ago contended that there was no need for legislative action and opposed both the creation of a Department of Science and Technology and a commission to study the creation of such a department.

The administration view was that the President's Advisory Committee and the Federal Council for Science and Technology could provide all the information needed by the President to initiate a governmental reorganization that would correct current operational deficiencies. Berkner, apprehensive about a general reorganization by Congress, agreed. He said, Feb. 19, 1959, that "Any initiative for corrective action should originate in the Executive Branch of our government, where a carefully prepared and well-reasoned plan can be presented to Congress."

Organization of the Sciences in Russia

ACCELERATION of this country's scientific efforts has been necessitated by the startling success of Soviet scientists in the fields of nuclear physics and rocketry. It had been thought that scientists working in a free society would be more productive and creative than those working in a totalitarian society. Such thinking did not take into account the fact that Russia has a professionally trained echelon of scientists and engineers larger by one-fifth than the corresponding group in the United States, nor the effectiveness of the coordinated scientific efforts of a highly centralized scientific machine.[25]

Despite widely acclaimed success, Soviet science and technology currently are experiencing organizational troubles which stem from over-compartmentalization and bureaucratic red tape. The general assembly of the Soviet Academy of Sciences approved a new constitution on March 28, 1959, to replace one in effect since 1935. Since that year, government appropriations to the Academy had increased 32 times over, the number of its scientific institutions had tripled, and its personnel had increased ninefold. The new constitution aims at strengthening the role of the Academy as the highest national scientific institution and scientific agency of the state, guiding and coordinating all scientific activities in the U.S.S.R.

The Academy of Sciences currently controls about 195 scientific institutions and coordinates the activities of a dozen affiliated academies of science in individual republics of the Soviet Union and a Siberian branch nearing completion at Novosibirsk. The Siberian branch is expected to reduce the strategically unsound concentration of science and industry around Moscow and Leningrad and to bring science into closer harmony with the expanding needs of Siberian industry and agriculture.

Although the Academy at one time had almost complete authority over planning of the most important scientific work, it now cooperates with other groups under a broadened scheme of organization. Gosplan, the state planning

[25] Donald F. Chamberlain, "Administration of Research in the Soviet Union," *Proceedings* of 12th National Conference on the Administration of Research (Pennsylvania State University, 1959), p. 113.

committee, at present controls a number of central scientific research institutes and design bureaus in certain basic industrial fields such as steel. The All-Union Ministries of Defense, Medium Machine Building (nuclear weapons), Communications, Health, and Agriculture control institutions conducting research related to their respective fields. The state committees of defense, technology, aviation, radio-electronics, shipbuilding, chemistry, automation, and machine building control research institutions responsible for scientific work directly related to the Soviet defense effort or to high-priority non-defense projects. Finally, the Ministry of Higher and Specialized Secondary Education controls a majority of research projects in the Soviet Union.

Decisions by the Central Committee of the Communist Party involving science or technology seem to be limited to general organizational problems and to establishment of economic priorities which, in turn, determine priorities in scientific research. After broad policy directives have been approved by the Academy, decisions by the party appear to be limited to: 1) specific problems involving initiation of research and development programs which require considerable investment, such as a space satellite station; 2) ideological or political issues of major importance in the scientific community; 3) major deviations from previous party policy.[26] Although attempts are being made to decentralize the management of research institutes located near major enterprises, it is likely that certain areas which the Soviets consider most important, such as nuclear physics, will continue to remain under centralized party control.[27]

Obviously, the Soviet Union, which increased its science budget for 1960 by 15 per cent over that of 1959, is placing steadily increasing emphasis on scientific and technological growth. Donald F. Chamberlain, chief of the Fundamental Science Division of the Central Intelligence Agency, considers it significant that "they can recognize their ailments" and make sweeping changes to overcome them. This in Chamberlain's opinion is "suggestive of considerable potential to improve further their system" and poses a formidable challenge to the United States.[28]

[26] *National Policy Machinery in the Soviet Union* (Report of Senate Committee on Government Operations, Jan. 20, 1960), p. 60.

[27] "Soviets Reorganize Science Management," *Aviation Week*, July 13, 1959, p. 69.

[28] Donald F. Chamberlain, *op. cit.*, p. 117.